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U.S. AIR FORCE
Project **RAND** FC

RESEARCH MEMORANDUM

AVERAGE PERCENT OF TARGET AREA COVERED (U)

A. M. Mood

RM-404

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AVERAGE PERCENT OF TARGET AREA COVERED

A. M. Mood

1. Introduction

This memorandum presents two numerical tables. The first gives the average percent of target area covered at least once for a wide range of bomb pattern sizes and target sizes. The second table is an auxiliary table which makes it easy for one to compute the average percent of target area covered exactly or at least once, twice, three times, etc. Both pattern and target areas are squares, and the number of bombs ranges from one to ten.

2. Basic Formulas

If a square pattern of area P^2 is aimed with normally distributed error at the center of a square target (with the same orientation) of area $\bar{T}^2$, the probability that a point (x, y) in the target will be covered is

$$\int_{y-\frac{1}{2}P}^{y+\frac{1}{2}P} \int_{x-\frac{1}{2}P}^{x+\frac{1}{2}P} \frac{1}{2\pi\sigma^2} e^{-\frac{1}{2\sigma^2}(u^2+v^2)} du\, dv = g(x)g(y)$$

where it is assumed that aiming errors in range and deflection are independent and have the same standard deviation σ. Supposing n bombs are dropped, the probability that the point (x, y) will be covered exactly k times is

$$\binom{n}{k} \left[g(x)g(y) \right]^{k} \left[1 - g(x)g(y) \right]^{n-k}$$

which may be put in the form

$$b_n^k(x, y) = (-1)^{n-k} \binom{n}{k} \sum_{i=0}^{n-k} (-1)^i \binom{n-k}{i} \left[g(x)g(y) \right]^{n-1} \qquad (1)$$

$$= (-1)^{n-k} \sum_{i=0}^{n-k} (-1)^i \binom{n-k}{k} \binom{n}{i} \left[g(x)g(y) \right]^{n-1} .$$

If this expression is summed on k from r to n, one obtains the
probability that (x, y) is covered at least r times

$$c_n^r(x, y) = \sum_{k=r}^{n} \sum_{i=0}^{n-k} (-1)^{r-k+i} \binom{n-1}{k} \binom{n}{i} \left[g(x)g(y) \right]^{n-1}$$

and by interchanging the order of summation the sum on k is easily
determined from the identity

$$\sum_{a=r}^{m} (-1)^a \binom{m}{a} = (-1)^r \binom{m-1}{r-1} .$$

One finds that

$$c_n^r(x, y) = \sum_{i=0}^{n-r} (-1)^{n+i+r} \binom{n-i-1}{r-1} \binom{n}{i} \left[g(x)g(y) \right]^{n-1}$$

$$= \sum_{j=r}^{n} (-1)^{j+r} \binom{j-1}{r-1} \binom{n}{j} \left[g(x)g(y) \right]^{j} .$$

The expected proportion of the target area covered at least
r times is now found by integrating this last expression over the

target area. Letting

$$\sqrt{J_i} = \frac{1}{T} \int_{-\frac{1}{2}T}^{\frac{1}{2}T} [g(x)]^i \, dx ,$$ (2)

the expected r-fold coverage may be written

$$h_n^r = \sum_{i=r}^{n} (-1)^{i+r} \binom{i-1}{r-1} \binom{n}{i} J_i .$$ (3)

3. Description of Tables

Table I tabulates h_n^i defined by equation (3); that is, it gives the expected proportion of target area covered at least once. Table II tabulates J_i defined by equation (2); this table together with equation (3) enables one to calculate directly the expected proportion of target area covered at least r times. Also, by substitution of J_{n-i} for $[g(x)g(y)]^{n-i}$ on the right of equation (1), one can compute directly the expected proportion of target area covered exactly k times.

The unit of length is taken to be one circular probable error (CEP). If the aiming errors in range and deflection are independent and have the same standard deviation σ, then

$$1 \text{ CEP} = \sqrt{2 \log 2} \; \sigma \approx 1.177 \, \sigma .$$

(One mean radial error (MRE) $= \sqrt{\pi/2} \; \sigma \approx 1.253 \sigma \approx 1.064 \text{ CEP}.$)
Thus the lengths of the target side and pattern side are denoted
by
$$t = T/CEP$$
$$p = P/CEP$$

in the tables.

TABLE I

Average Percent of Target Area Covered at Least Once

p	t	Number of Bombs									
		1	2	3	4	5	6	7	8	9	10
.0625	.0625	.0009	.0017	.0026	.0034	.0043	.0052	.0060	.0069	.0077	.0086
	.125	.0009	.0017	.0026	.0034	.0043	.0051	.0060	.0069	.0077	.0086
	.25	.0009	.0017	.0026	.0034	.0043	.0051	.0060	.0068	.0077	.0085
	.50	.0008	.0017	.0025	.0033	.0042	.0050	.0058	.0067	.0075	.0083
	1.00	.0008	.0015	.0023	.0031	.0038	.0046	.0054	.0061	.0069	.0077
	2.00	.0006	.0011	.0017	.0023	.0028	.0034	.0040	.0045	.0051	.0056
	4.00	.0002	.0005	.0007	.0009	.0012	.0014	.0016	.0019	.0021	.0023
	8.00	.0001	.0001	.0002	.0002	.0003	.0004	.0004	.0005	.0005	.0006
	16.00	.0000	.0000	.0001	.0001	.0001	.0001	.0001	.0001	.0002	.0002
.125	.0625	.0034	.0069	.0103	.0137	.0171	.0205	.0238	.0272	.0305	.0339
	.125	.0034	.0069	.0103	.0137	.0171	.0204	.0238	.0272	.0305	.0338
	.25	.0034	.0068	.0102	.0136	.0170	.0203	.0237	.0270	.0303	.0336
	.50	.0033	.0067	.0100	.0133	.0166	.0199	.0232	.0264	.0297	.0329
	1.00	.0031	.0061	.0092	.0122	.0153	.0183	.0213	.0243	.0273	.0303
	2.00	.0023	.0045	.0068	.0090	.0112	.0135	.0157	.0179	.0201	.0223
	4.00	.0009	.0019	.0028	.0038	.0047	.0056	.0065	.0075	.0084	.0093
	8.00	.0002	.0005	.0007	.0010	.0012	.0014	.0017	.0019	.0022	.0024
	16.00	.0001	.0001	.0002	.0002	.0003	.0004	.0004	.0005	.0005	.0006
.25	.0625	.0137	.0272	.0405	.0536	.0666	.0793	.0919	.1044	.1166	.1287
	.125	.0137	.0271	.0404	.0536	.0665	.0792	.0918	.1042	.1165	.1286
	.25	.0136	.0270	.0402	.0533	.0661	.0788	.0914	.1037	.1159	.1279
	.50	.0133	.0264	.0394	.0522	.0648	.0772	.0895	.1016	.1136	.1254
	1.00	.0122	.0243	.0363	.0481	.0597	.0712	.0826	.0938	.1049	.1158
	2.00	.0090	.0179	.0268	.0355	.0442	.0528	.0613	.0697	.0780	.0863
	4.00	.0038	.0075	.0112	.0149	.0185	.0222	.0258	.0293	.0329	.0364
	8.00	.0010	.0019	.0029	.0038	.0048	.0057	.0066	.0076	.0085	.0094
	16.00	.0002	.0005	.0007	.0010	.0012	.0014	.0016	.0019	.0021	.0023

TABLE I (cont'd)

Average Percent of Target Area Covered at Least Once

p	t	Number of Bombs									
		1	2	3	4	5	6	7	8	9	10
.5	.0625	.0536	.1043	.1523	.1977	.2407	.2613	.3198	.3563	.3908	.4234
	.125	.0535	.1041	.1521	.1974	.2404	.2810	.3195	.3559	.3904	.4230
	.25	.0532	.1036	.1513	.1965	.2393	.2797	.3181	.3544	.3887	.4213
	.50	.0521	.1015	.1484	.1927	.2348	.2747	.3125	.3483	.3823	.4145
	1.00	.0480	.0937	.1372	.1786	.2181	.2556	.2913	.3252	.3576	.3884
	2.00	.0356	.0698	.1027	.1343	.1648	.1941	.2223	.2494	.2755	.3007
	4.00	.0150	.0296	.0438	.0575	.0710	.0840	.0967	.1091	.1211	.1329
	8.00	.0039	.0077	.0114	.0150	.0185	.0219	.0253	.0285	.0317	.0348
	16.00	.0010	.0019	.0028	.0037	.0045	.0053	.0060	.0068	.0075	.0082
1	.0625	.1970	.3552	.4822	.5842	.6661	.7319	.7847	.8271	.8612	.8885
	.125	.1968	.3548	.4818	.5837	.6656	.7314	.7843	.8267	.8608	.8882
	.25	.1958	.3533	.4799	.5818	.6637	.7295	.7825	.8251	.8593	.8869
	.50	.1921	.3473	.4727	.5740	.6558	.7219	.7753	.8184	.8533	.8815
	1.00	.1782	.3245	.4447	.5434	.6244	.6911	.7458	.7908	.8278	.8583
	2.00	.1349	.2505	.3497	.4349	.5083	.5715	.6261	.6732	.7140	.7494
	4.00	.0593	.1125	.1604	.2036	.2427	.2783	.3108	.3405	.3678	.3930
	8.00	.0156	.0297	.0425	.0540	.0646	.0743	.0831	.0913	.0989	.1059
	16.00	.0039	.0074	.0106	.0135	.0161	.0186	.0208	.0228	.0247	.0265
2	.0625	.5789	.8227	.9253	.9686	.9868	.9944	.9977	.9990	.9996	.9998
	.125	.5784	.8223	.9251	.9684	.9867	.9944	.9976	.9990	.9996	.9998
	.25	.5765	.8206	.9240	.9678	.9864	.9942	.9976	.9990	.9996	.9998
	.50	.5689	.8141	.9198	.9654	.9851	.9936	.9972	.9988	.9995	.9998
	1.00	.5396	.7875	.9016	.9543	.9787	.9901	.9953	.9978	.9990	.9995
	2.00	.4407	.6810	.8147	.8905	.9342	.9599	.9752	.9844	.9901	.9937
	4.00	.2257	.3781	.4860	.5659	.6270	.6752	.7142	.7463	.7732	.7960
	8.00	.0625	.1064	.1391	.1645	.1850	.2022	.2168	.2296	.2409	.2511
	16.00	.0156	.0266	.0348	.0411	.0463	.0505	.0542	.0574	.0602	.0628

TABLE I (cont'd)

Average Percent of Target Area Covered at Least Once

p	t	Number of Bombs									
		1	2	3	4	5	6	7	8	9	10
4	.0625	.9632	.9986	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	.125	.9631	.9986	.9999	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	.25	.9624	.9986	.9999	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	.50	.9599	.9984	.9999	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	1.00	.9494	.9974	.9999	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	2.00	.9028	.9890	.9986	.9998	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	4.00	.6899	.8744	.9418	.9708	.9845	.9915	.9951	.9971	.9983	.9990
	8.00	.2493	.3541	.4169	.4612	.4951	.5225	.5454	.5650	.5821	.5972
	16.00	.0625	.0889	.1047	.1160	.1246	.1316	.1375	.1426	.1470	.1509
8	.0625	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	.125	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	.25	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	.50	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	1.00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	2.00	.9999	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	4.00	.9974	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	8.00	.8378	.9438	.9760	.9892	.9947	.9972	.9985	.9992	.9995	.9997
	16.00	.2500	.3063	.3372	.3581	.3738	.3864	.3968	.4056	.4133	.4201
16	.0625	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	.125	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	.25	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	.50	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	1.00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	2.00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	4.00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	8.00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	16.00	.9171	.9735	.9897	.9956	.9980	.9990	.9995	.9997	.9999	.9999

TABLE II

Value of J_1

p	t	1	2	3	4	5	6	7	8	9	10
.0625	.0625	.0008611	.0000007	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	.125	.0008599	.0000007	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	.25	.0008553	.0000007	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	.50	.0008171	.0000007	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	1.00	.0007695	.0000006	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	2.00	.0005653	.0000003	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	4.00	.0002352	.0000001	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	8.00	.0000605	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	16.00	.0000171	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.125	.0625	.0034397	.0000118	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	.125	.0034350	.0000118	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	.25	.0034165	.0000117	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	.50	.0033440	.0000112	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	1.00	.0030745	.0000095	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	2.00	.0022595	.0000055	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	4.00	.0009405	.0000017	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	8.00	.0002421	.0000004	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	16.00	.0000605	.0000002	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000

TABLE II (cont'd)

Values of J_1

p	t	1	2	3	4	5	6	7	8	9	10
.25	.0625	.0136845	.0001873	.0000026	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	.125	.0136662	.0001868	.0000026	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	.25	.0135930	.0001848	.0000025	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	.50	.0133059	.0001771	.0000024	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	1.00	.0122389	.0001506	.0000019	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	2.00	.0090078	.0000872	.0000009	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	4.00	.0037596	.0000267	.0000002	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	8.00	.0009636	.0000066	.0000001	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	16.00	.0002421	.0000024	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.5	.0625	.0535711	.0028702	.0001538	.0000088	.0000004	.0000000	.0000000	.0000000	.0000000	.0000000
	.125	.0535037	.0028626	.0001532	.0000062	.0000004	.0000000	.0000000	.0000000	.0000000	.0000000
	.25	.0532234	.0028328	.0001508	.0000090	.0000004	.0000000	.0000000	.0000000	.0000000	.0000000
	.50	.0521229	.0027176	.0001447	.0000074	.0000004	.0000000	.0000000	.0000000	.0000000	.0000000
	1.00	.0480272	.0023179	.0001124	.0000055	.0000003	.0000000	.0000000	.0000000	.0000000	.0000000
	2.00	.0355541	.0013547	.0000547	.0000023	.0000001	.0000000	.0000000	.0000000	.0000000	.0000000
	4.00	.0149988	.0004177	.0000149	.0000006	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	8.00	.0039062	.0001047	.0000038	.0000002	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
	16.00	.0009690	.0000376	.0000015	.0000001	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000

TABLE II (cont'd)

Values of J_1

p	t	1	2	3	4	5	6	7	8	9	10
1	.0625	.1970043	.0388107	.0076459	.0015063	.0002967	.0000585	.0000115	.0000023	.0000004	.0000001
	.125	.1967673	.0387174	.0076183	.0014990	.0002950	.0000580	.0000114	.0000022	.0000004	.0000001
	.25	.1958230	.0383473	.0075095	.0014706	.0002890	.0000564	.0000110	.0000022	.0000004	.0000001
	.50	.1921086	.0369154	.0070955	.0013642	.0002623	.0000505	.0000097	.0000019	.0000004	.0000001
	1.00	.1782003	.0318858	.0057281	.0010330	.0001870	.0000340	.0000062	.0000011	.0000002	.0000000
	2.00	.1349030	.0193056	.0029039	.0004551	.0000737	.0000123	.0000021	.0000004	.0000001	.0000000
	4.00	.0592405	.0061492	.0008111	.0001200	.0000187	.0000031	.0000005	.0000001	.0000000	.0000000
	8.00	.0156248	.0015422	.0002030	.0000298	.0000047	.0000010	.0000002	.0000000	.0000000	.0000000
	16.00	.0039063	.0003857	.0000507	.0000075	.0000012	.0000002	.0000000	.0000000	.0000000	.0000000
2	.0625	.5789112	.3351382	.1940153	.1123176	.0650219	.0376419	.0217923	.0126153	.0073031	.0042279
	.125	.5784277	.3345788	.1935298	.1119432	.0647512	.0374640	.0216645	.0125314	.0072485	.0041928
	.25	.5764990	.3323537	.1916046	.1104625	.0636836	.0367110	.0211671	.0122035	.0070358	.0040564
	.50	.5693664	.3236501	.1841602	.1048022	.0596485	.0337353	.0193294	.0110055	.0062669	.0035690
	1.00	.5596130	.2917682	.1580701	.0858018	.0466614	.0254222	.0138753	.0075861	.0041546	.0022790
	2.00	.4406502	.2002614	.0935567	.0447806	.0218915	.0108988	.0055116	.0028248	.0014645	.0007667
	4.00	.2256616	.0733043	.0288678	.0126350	.0058758	.0028427	.0014436	.0007173	.0003696	.0001896
	8.00	.0624945	.0185453	.0072333	.0031594	.0014690	.0007107	.0003534	.0001793	.0000924	.0000482
	16.00	.0156250	.0046363	.0018083	.0007899	.0003672	.0001777	.0000888	.0000448	.0000231	.0000121

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TABLE II (cont'd)

Values of J_1

p	t	1	2	3	4	5	6	7	8	9	10
4	.0625	.9632280	.9278083	.9936910	.8608282	.8291739	.7986835	.7693144	.7410252	.7137763	.6875299
	.125	.9630719	.9275075	.8932564	.8602702	.8285021	.7979072	.7684421	.7400651	.7127360	.6364161
	.25	.9624458	.9263022	.8915162	.8580368	.8258149	.7948033	.7649564	.7362307	.7085838	.6819754
	.50	.9599179	.9214470	.8845223	.8490914	.8150645	.7824144	.7510758	.7209960	.6921243	.6644120
	1.00	.9494467	.9015277	.8561015	.8130346	.7722005	.7334802	.6967608	.6619357	.6289043	.5975714
	2.00	.9027744	.8165771	.7400001	.6718309	.6110259	.5566828	.5080209	.4643659	.4251258	.3897915
	4.00	.6898762	.5053195	.3381747	.3094629	.2539129	.2130421	.1819048	.1574863	.1378731	.1218039
	8.00	.2493391	.1445796	.1026608	.0793127	.0642014	.0535417	.0455891	.0394181	.0344878	.0304593
	16.00	.0625000	.0361455	.0256652	.0198282	.0160504	.0133854	.0113973	.0098545	.0086219	.0076148
8	.0625	.9999950	.9999900	.9999850	.9999800	.9999751	.9999701	.9999651	.9999601	.9999551	.9999501
	.125	.9999949	.9999899	.9999848	.9999797	.9999747	.9999696	.9999645	.9999595	.9999544	.9999493
	.25	.9999946	.9999892	.9999838	.9999785	.9999731	.9999677	.9999623	.9999569	.9999515	.9999461
	.50	.9999932	.9999865	.9999797	.9999730	.9999662	.9999594	.9999527	.9999459	.9999392	.9999324
	1.00	.9999855	.9999719	.9999578	.9999437	.9999296	.9992156	.9999015	.9998874	.9998734	.9998593
	2.00	.9999127	.9998253	.9997380	.9996507	.9995635	.9994762	.9993889	.9993017	.9922145	.9991273
	4.00	.9947561	.9947276	.9921182	.9895232	.9869440	.9343306	.9818328	.9793005	.9747836	.9742424
	8.00	.8377602	.7317008	.6584013	.6052128	.5649567	.5.33745	.5078365	.4866583	.4657235	.4532683
	16.00	.2500000	.1936904	.1682263	.1526591	.1417776	.1575659	.1270535	.1217055	.1174989	.1133251

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TABLE II (cont'd)

Values of J_1

p	t	1	2	3	4	5	6	7	8	9	10
16	.0625	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
	.125	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
	.25	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
	.50	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
	1.00	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
	2.00	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
	4.00	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
	8.00	1.0000000	1.0000000	1.0000000	.9999996	.9999995	.9999994	.9999993	1.0000000	1.0000000	1.0000000
	16.00	.9170962	.8606227	.8203100	.7902803	.7670572	.7485061	.7332724	.7204691	.7094978	.6999431